# FOREST PRODUCTS
## Project Fact Sheet

# A NEW FREEZE CONCENTRATION PROCESS FOR MINIMUM EFFLUENT PROCESSES IN BLEACHED PULP MILLS

### BENEFITS

- With the new process, very low concentrations of organic halides from elemental chlorine-free (ECF) bleaching plants (comparable to total chlorine-free bleaching processes)
- Minimal levels of non-process elements and organic compounds in the effluent system
- Pure recycled water from the freeze concentration process
- 15 percent less energy use than if water were removed by evaporation
- Allows bleach plant closure without adversely affecting liquor recovery cycle

### APPLICATIONS

The new process will help U.S. pulp mills meet the standards of the Environmental Protection Agency for adsorbable organic halides in effluents (0.05 kg/ton of pulp), and for bleach effluent flow volume (5 m3/ton of pulp). The process will enable American pulp and paper mills to continue using ECF bleaching processes, avoiding the need for costly and energy-intensive retrofit technologies. Data obtained from a pilot plant study will include an economic analysis of the process, and will lead to a design for an industrial plant using the process.

## New Process Will Concentrate Contaminants for Easy Removal from Mill Effluent

The effluents from pulp mills are being closely controlled for their total volume of contaminants, especially for the amount of organic halides they contain. These regulations will be extended shortly to mills using elemental chlorine-free (ECF) bleaching processes, and estimates are it would cost more than $10 billion for North American mills to meet the new standards using available technologies. Continuation of ECF bleaching will require the development of a technology that can achieve effluent concentrations comparable to total chlorine-free (TCF) bleaching while avoiding the problematic build-up of non-process elements.

Techniques such as evaporation or membrane filtration are not effective in concentrating the complex mixture of organic halogenated compounds found in typical mill effluents. However, freeze concentration of the effluent recovers both volatile and complex contaminants if the water content is removed as ice. There are also no gas emissions from this closed system, and the usual build-up of non-process elements such as chlorides during water recycling in mills is eliminated.

The investigators have developed a unique process for freeze concentration that is suitable for treating large waste streams. More than 96 percent of the adsorbable organic halides and chlorides were removed from an ECF bleaching effluent in the laboratory. The process was also shown to be feasible using a laboratory modeling system. The current project is an effort to successfully demonstrate the new process on a pilot scale.

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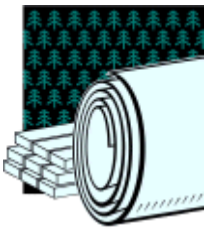
## PROJECT DESCRIPTION

**Goal:** To scale-up the process so it is suitable for effluent-treatment units in mills, and to collect data on the economics and design of the technology for industrial pulp plants.

This will be a three-year effort in which the laboratory tests conducted previously will be repeated using a larger-scale apparatus. A unique feature of the new process is use of ultrasound to separate the nucleation of ice crystals from crystal growth in the supercooled solution. This allows a fine control of the nucleation process, and makes it easier to scale-up the procedure to handle the large volumes of effluent found in mills than if the existing technology for freeze concentration were used.

## PROGRESS & MILESTONES

- In year one, a 100-liter crystallizer previously developed was reconstructed to conduct freeze concentration trial runs, and nucleators were designed and tested for larger crystallizers.
- The second and third year will include experiments with the crystallizer and nucleators, and a 1,000-liter pilot plant system will be designed and operated on the sites of the industrial partners.
- Compare acoustic stiffness data with transducer-based measurements.
- Partners will also cooperate in evaluating data and in analyzing and reaching conclusions about the costs of using this process in mills.
- The last phase of the project calls for the partners to design an industrial-scale plant.



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